

Energy Policy: Hydrogen and Nuclear Energy Research and Development Legislation." One gentleman that was asked to testify was Arthur T. Katsaros, who spoke on behalf of Air Products and Chemicals, Inc., a Pennsylvania based company that has been researching and developing the utilization of hydrogen as a fuel source. With the recent coverage of energy and our plans for future use in the United States, I would ask that his testimony be submitted for others to view and learn more about this abundant source:

INTRODUCTION

Mr. Chairman, Ms. Woolsey, and members of the Subcommittee, thank you for the opportunity to testify this morning on a subject that may seem futuristic but is actually upon us—the utilization of hydrogen as a fuel source. No matter what one's perspective is on climate change and the role of fossil fuels in the current economy, there is a broad consensus that the United States and the world are moving toward a "hydrogen economy" in which fuel is abundant, efficient, renewable, and non-polluting. There is debate over how soon hydrogen will be widely available as a fuel source, but little debate over hydrogen's many virtues. I am pleased to address the viability of hydrogen as a fuel source today and in the years and decades ahead, and to address perfectly legitimate concerns about assuring its safe use. I ask that my full testimony be submitted for the record.

I am Arthur Katsaros, Group Vice President for Engineered Services and Development with Air Products and Chemicals, Inc., a Fortune 500 company based in Allentown, Pennsylvania, and with operations throughout the world. Air Products is among the world's largest companies in the industrial gas business, and is the leading producer of third-party hydrogen worldwide. Air Products is a recent past chair of the National Hydrogen Association (NHA), whose members include industrial gas producers, automobile manufacturers, energy providers, chemical companies, universities, and research institutions. I am pleased to be appearing on behalf of both Air Products and the NHA.

SUPPORT FOR HYDROGEN FUTURE ACT

NHA members wholeheartedly support reauthorization of the Hydrogen Future Act. Indeed, given the focus on hydrogen in the National Energy Policy recently released by the White House, we hope that funding for hydrogen will be increased rather than held constant. The timing is right for the United States to be putting scarce research and development resources into hydrogen as a fuel source.

The public is clearly committed to environmental protection. Energy concerns have also come to the fore, both as a result of electricity disruptions in California and the higher fuel prices that we all are facing. Policy makers will find it impossible to discuss energy policy without having to also debate environmental impact. Embracing hydrogen certainly appears to be one answer to the tension between a clean environment and bountiful energy—it provides a method for delivering energy to stationary as well as mobile sources without pollution (its byproduct of combustion is water).

For reasons of environmental protection and sustainability, America needs to be on a path that relies increasingly less on carbon as a source of energy—we have moved over the past 150 years from coal, to oil, to natural gas, and we believe eventually our economy will be based primarily on hydrogen.

HYDROGEN IS A SAFE FUEL SOURCE

Every day, millions of pounds of hydrogen are used—and used safely—in hundreds of in-

dustries across the country and around the world (50 million pounds daily in the U.S. alone). As the world's largest third-party hydrogen generator and supplier, Air Products has been addressing hydrogen safety, storage, transportation and other infrastructure concerns for decades. We put an extremely high value on safety at Air Products. The American Chemistry Council last year gave Air Products its highest award for safety. Our experience shows that hydrogen can be handled safely when guidelines for its safe storage, handling and use are observed.

Hydrogen is a fuel, and as a fuel it has combustible properties. Hydrogen's combustion properties warrant the same caution any fuel should be given, and like all fuels there are safety measures unique to hydrogen (most people do not refill their own propane tanks, for example, yet propane is widely used at home). There is no scientific or practical barrier to the safe use of hydrogen as a fuel.

Safety technologies for hydrogen have progressed in several areas. Gas detection and measurement capability has advanced based in part on the extensive investment of the Department of Energy in the last few years. Several of these technologies are becoming available as commercial products. Hydrogen flame detection has progressed mainly from the commercialization of technology used by the National Aeronautics and Space Administration (NASA). NASA today uses infrared and ultraviolet detection systems that can detect not only invisible flames produced by burning hydrogen, but also those hidden behind a screen of smoke. In addition, a series of hydrogen sensors has proven to be capable of detecting hydrogen leaks prior to ignition.

Air Products operates hundreds of miles of hydrogen pipelines in the U.S. In California alone, we produce approximately 300 million standard-cubic-feet-per-day of hydrogen, which is transported to petroleum refiners in the state to reduce the sulfur, olefins and aromatics content in transportation fuels. Safety is the paramount concern in the operation of our hydrogen pipelines. Our pipeline integrity management program—which exceeds regulatory requirements—includes risk assessment studies that typically result in the use of multiple safety technologies on our hydrogen pipelines, including heavier pipeline wall thickness, excess flow valves and isolation valves, along with intensive testing, inspection and maintenance procedures. We have been working closely with the U.S. DOT Office of Pipeline Safety on the development of regulations increasing safety practices on hydrogen and other flammable gas pipelines. The promulgation of these regulations will be critical to the development of a safe and reliable hydrogen pipeline infrastructure in the U.S.

In addition to delivering hydrogen to customers through pipelines, Air Products also liquefies hydrogen at cryogenic temperatures (–423 °F) and transports it by truck and barge. We drive 15,000-gallon hydrogen tanker trucks millions of miles per year on U.S. highways without incident. NASA, the largest consumer of liquid hydrogen in the world, has been buying hydrogen for the space program from Air Products for over 35 years under consecutive competitive contracts, totaling over 300 million pounds of liquid hydrogen. Every Space Shuttle flight has been powered by our liquid hydrogen.

CODES AND STANDARDS TRANSLATE INTO PUBLIC TRUST

Hydrogen energy safety is based on three primary elements: regulatory requirements, capability of safety technology, and the systematic application of equipment and procedures to minimize risks. Industry currently implements many successful proprietary

methodologies for safely handling large amounts of hydrogen. There are several codes and standards specifically for hydrogen fuel applications that are under development by international, U.S. and industry organizations (including ISO, DOE and NHA). There are also many efforts underway to standardize hydrogen system component manufacture for hydrogen safety in a variety of potential commercial hydrogen market applications.

Widespread hydrogen use will require that safety be intrinsic to all processes and systems. To develop a hydrogen infrastructure that has the public's confidence in its safety and convenience, an industry consensus on safety issues is required. This includes the development of compatible standards and formats (e.g., the same couplings for dispensing the same form of fuel). Product certification protocols are also required. The development of codes and standards for the safe use of hydrogen is an essential aspect of the U.S. Department of Energy Hydrogen Program.

Utilizing industry expertise and coordinating with government and other official entities, this barrier to commercialization may be overcome, allowing siting of hydrogen components and systems on a worldwide basis. Indeed, the NHA works with leading code- and standard-setting organizations around the world to develop and publish industry consensus standards that account for the outstanding safety record of hydrogen. The workshops, technical meetings, manuals, reports, and sourcebooks of the NHA characterize an industry that wants to leave no stone unturned in a commitment to safety and public trust. We will continue to work with policy makers on standards and codes that promote safety and encourage public confidence in the use of hydrogen in fuel cells and direct combustion.

COMMERCIALIZATION IS COMING, BUT IT REQUIRES GOVERNMENT SUPPORT

Our international competitors—often with major help from their governments—are pouring substantial resources into hydrogen research. We believe that hydrogen will be widely used commercially within a generation—if not in the United States, then surely in Western Europe, where a consensus exists that climate change must be addressed. The Japanese have a \$2.8 billion long-term hydrogen program called World Energy Network. Major automakers around the world are planning to sell fuel cell cars within the next five years. Clearly, the race for global dominance in hydrogen fuel technology has begun.

Through our involvement in multiple demonstration projects in North America and Europe, Air Products is very much engaged in the race to commercialize hydrogen technologies. Some examples of our involvement include the design and installation of fueling systems for a hydrogen fuel cell bus demonstration program for the Chicago Transit Authority; Ford Motor Company's fuel cell automobile development facility in Dearborn, Michigan; and a fleet of fuel cell service vehicles for the Palm Springs, California's Airport. Air Products is leading the hydrogen fuel provider team for the California Fuel Cell Partnership. In the next three years, more than 70 fuel cell-powered cars and buses will be placed on the road from the Partnership's West Sacramento facility. We recently installed a gaseous hydrogen fueling station in Atlanta, Georgia for a hydrogen fuel bus project conducted by a consortium of companies led by the Southeastern Technology Center. Air Products has successfully tested the use of Hythane—a blend of hydrogen and natural gas used as an ultra-clean fuel—in projects in Denver, Colorado,